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Pocket-Size 18-Range Digital Multimeter

Owner's Manual
Please read before using this equipment.

SPECIAL PANEL MARKINGS

For your safety, we have added special markings to the meter's panel to remind you of the measurement limitations.

Caution: Risk of electric shock! Refer to the complete operating instructions.

Caution: Be extra careful when making high-voltage measurements. DO NOT TOUCH TERMINALS OR TEST LEAD ENDS.

WARNING: To reduce the risk of fire or shock hazard, do not expose this product to rain or moisture.		
	**CAUTION** RISK OF ELECTRIC SHOCK. DO NOT OPEN.	

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER OR BACK. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL.

This symbol is intended to alert you to the presence of uninsulated dangerous voltage within the product's enclosure that might be of sufficient magnitude to constitute a risk of electric shock. Do not open the product's case.

This symbol is intended to inform you that important operating and maintenance instructions are included in the literature accompanying this product.

Warnings:

- USE EXTREME CAUTION IN USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES. NOT FOR COMMERCIAL OR INDUSTRIAL USE.

- IF THIS EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.
- TO REDUCE THE RISK OF FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE.

A WORD ABOUT SAFETY

We have taken every precaution in designing this meter to ensure that it is as safe as we can make it. Safe operation depends on you, the operator. We recommend that you follow these simple safety rules.

- Never apply voltages to the meter that exceed the limits given in the specifications. Never apply more than 500V DC or 500V AC between the test leads and ground.
- Use extreme caution when working with voltages above 100V. Always disconnect

power from the circuit you are measuring before you connect test leads to high-voltage points.

- Never connect to a source of voltage when you select the diode check or resistance measurement function.
- Always discharge any capacitors of the circuit under test before you attach test leads.
- Always turn off power and disconnect the test leads from the circuit you are testing before you replace the meter's battery.
- Never operate the meter unless its battery compartment cover is fully closed with the screw fully tightened.
- This equipment is rated for installation CAT II 300V.

- Because many AC/DC sets have a potentially hot chassis, be sure the top of your workbench and the floor underneath it are made of non-conductive materials.
- This meter is fully calibrated and tested. Under normal use, no further adjustment is required. If the meter requires repair, do not try to adjust it yourself. Take it to your local RadioShack store.

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❒ Features

Your RadioShack Pocket Size 18-Range Digital Multimeter is a portable, compact multimeter that is ideal for field, lab, shop, and home applications. Its $3^{3}/_{4}$-digit digital display can show up to 3,200 units. It measures AC voltage up to 500 V, DC voltage up to 500 V, and resistance up to 30 MΩ.

Your meter's modern semiconductor technology brings "big meter" performance to a pocket-sized instrument. The multimeter's other features include:

Data Hold — holds data on the display to free your hands.

Auto Power Off — automatically turns power off about 10 minutes after you stop using the meter.

Hard Case — protects the meter and secures the test leads inside its compartment.

Low-Battery Indicator — shows you when battery power is low.

Diode Check Function — lets you safely check semiconductors for open, shorted, or normal junctions.

Continuity Function — quickly checks the continuity of wires or traces, and buzzes if the wire or trace is continuous.

Latest Integrated Circuit (IC) and Display Technology — ensures reliability, accuracy, stability, and ease of operation.

1.5 Volt Button Cell Battery Tester — lets you test button-cell battery power.

UL Listed — the meter passes the stringent safety tests required by Underwriters Laboratories.

Important:

- This meter is not designed for outdoor use.
- Completely read this manual before you use the meter.
- If you are not familiar with multimeters and testing procedures, we suggest you read *Using Your Meter* (RadioShack Cat. No. 62-2039, not supplied) before using the meter.

❒ *Specifications*

Display ..... LCD $3^{3}/_{4}$-Digit Digital 3200 Units Display

DC Volts

320mV ..... ± 0.8% of Reading, +4 Digits

3.2V/32V/320V/500V ... ± 1.3% of Reading, +4 Digits

AC Volts

3.2/32V/320V/500V (45 ~ 400 Hz) ±2.3 % Reading + 8 Digits

Resistance

320/3.2K/32K/320K Ohm . ±2.0 % Reading + 4 Digits

3.2M Ohm ..... ±3.5 % Reading + 4 Digits

32M Ohm ..... ±10 % Reading + 5 Digits

Miscellaneous

Range Control ..... Auto Range

Input Impedance ..... 10Ω (DC V/AC V)

Continuity Function ..... Buzzer Sounds at Less Than 20Ω

Operating Temperature	32° to 104°F (0° to 50°C)
Storage Temperature	14° to 122°F (–10° to 60°C)
Relative Humidity	80% RH (Maximum)
Power Source	Two 357A Batteries
Power Consumption	0.34mA (DCV)
Dimensions (HWD)	$^{14}/_{16} \times 3 \times 4^{5}/_{8}$ in ($18 \times 76 \times 117$ mm)
Weight (with Battery)	3.9 oz (110 g)

Specifications are typical; individual units might vary. Specifications are subject to change and improvement without notice.

❒ Operation

USING THE METER

Warning: Do not try to measure voltage greater than 500V DC or 500V AC.

Cautions:

- For the most accurate reading, the temperature should be between 64.4° and 82.4°F (18° and 28°C), with a relative humidity of no more than 80%, with no condensation.
- The test leads are permanently attached to the meter. Do not try to remove them.
- If **O.L** (overload) appears, the value you are measuring exceeds the meter's maximum range. This is normal when you measure resistance, diode, buzzer, or when you do not have the leads connected to a

component. If you are measuring voltage, immediately disconnect the test leads from the circuit.

1. To open the meter, press the latch on the case, then open the case. Remove the test leads from inside the case.

   When you take readings, keep the meter lying flat on a non-metallic surface.

2. Rotate the function switch to the function you want to use. Then connect the test leads to the circuit you want to measure. To measure different circuits, see “Making Measurements” on Page 17.

3. When you finish using the meter, set the function switch to **OFF**.

4. First place the wires, then the test leads inside their compartment to secure them.

5. Close the cover.

Your multimeter automatically sets itself to the range that gives the best reading. See the unit of measurement on the display to distinguish the range.

Measure	Range	Display	Accuracy	Remarks
Rdg = reading *dgt* = digits Accuracy in the case of sine wave AC.				
V⎓	320m V	0.1mV	±0.8% rdg + 4 dgt	Input impedance >100 MΩ
	3.2 V	1 mV	±1.3% rdg + 4 dgt	Input impedance approximately 11 MΩ
	32 V	10 mV	±1.3% rdg + 4 dgt	Input impedance approximately 10MΩ
	320 V	100 mV		
	500 V	1 V		
V~	3.2 V	1 mV	±2.3% rdg + 4 dgt For AC sine wave 45 Hz~400 Hz	Input impedance approximately 11 MΩ
	32 V	10 mV		Input impedance approximately 10MΩ
	320 V	100 mV		
	500 V	1 V		

Measure	Range	Display	Accuracy	Remarks
Ω	320Ω	0.1Ω	±2.0% rdg + 4 dgt 1.3V max test voltage	Test current <0.7mA
	3.2 KΩ	1Ω		Test current <0.13mA
	32 KΩ	10Ω		Test current <13μA
	320 KΩ	100Ω		Test current <1.3μA
	3.2 MΩ	1 KΩ	±3.5% rdg + 4 dgt	Test current <0.13μA
	32 MΩ	10 KΩ	±10% rdg + 4 dgt	
•))	320Ω	0.1Ω	Buzzer sound at approxi-mately <20Ω	Test current <0.7mA 1.3V max test voltage
▶|	3 V	1 mV	±10% rdg + 5 dgt	Test current approximately 0.6 mA 3V max test voltage

Measure	Range	Display	Accuracy	Remarks
1.5V	1.5V	1mV	±10% rdg + 5 dgt	

❒ *Making Measurements*

MEASURING DC/AC VOLTAGE

Warning: The maximum input limit for voltage measurement is 500V DC and 500V AC. To avoid electrical shock and damage to the meter, never try to measure a DC or AC voltage above 500 V.

Follow these steps to measure DC or AC voltage.

1. Set the function switch to $\underline{\underline{V}}$ (to measure DC voltage) or $\underline{V}$ (to measure AC voltage). All display segments briefly appear.

2. Connect the test leads to the circuit you want to test.

Note: If you are measuring a voltage that is exactly 3.2, 32, or 320V, **O.L** briefly appears.

MEASURING AC VOLTAGE RIDING ON A DC SOURCE BIAS

To measure an AC voltage superimposed on a DC voltage source bias, you must first measure the DC and AC voltages separately, then compute the peak voltage using this formula:

$$\textbf{Peak Voltage} = \textbf{DC Voltage} + \frac{\textbf{AC Voltage}}{\textbf{.707}}$$

Warnings:

- Never clamp a test lead to a hot wire (usually red, black or blue in AC wiring circuits). If one lead is clamped to a hot wire and you touch the meter's other lead, you could receive an electric shock.
- To avoid injury to yourself or damage to your multimeter, never try to measure an AC voltage that is riding on a DC source bias where the peak voltage exceeds 100 V with respect to earth ground.

Caution: Never try to measure any voltage more than 30V AC on a DC source bias.

Notes: The display might show a phantom reading in some DC and AC voltage ranges when the test leads are not connected to a circuit. This is normal. The high input sensitivity produces a "wandering" effect. When you con-

nect the test leads to a circuit, a real measurement appears.

Follow these steps to measure AC voltage riding on a DC voltage:

1. Set the function switch to V⎓.
2. Connect the test leads to the circuit you want to test. The display shows the DC voltage.
3. Disconnect the test leads from the circuit.
4. Set the function switch to V⏦.
5. Connect a 0.1 µf/100V Mylar capacitor in series with the positive terminal of the voltage source and the positive (+) test lead.
6. Connect the test leads to the circuit you want to test. The display shows the AC voltage.

7. Compute the peak voltage using the peak voltage formula (see “Measuring AC Voltage Riding on a DC Source Bias” on Page 18).

MEASURING RESISTANCE

The resistance measuring circuit in your meter compares the voltage gained through a known internal resistance with the voltage developed across an unknown resistance.

Warning: Be sure the circuit you are measuring has all power removed and any associated capacitors are fully discharged before you make a resistance measurement.

Caution: Your meter has a circuit to protect the resistance range from over-voltage. However, to prevent accidentally exceeding the protection circuit's rating and to ensure a correct measurement, never connect the test leads to a source of voltage while the function switch is set to **Ω**.

1. Set the function switch to Ω. All display segments briefly appear.

   Note: If there is no resistance connected across the test leads or the measured value exceeds separate ranges, **O.L** appears when you set the function switch to Ω. This is normal.

2. Connect the test leads across the circuit you want to measure, or remove one of the component's leads you want to measure from its circuit and connect the test leads across the component. The meter automatically reads and displays the proper range.

CHECKING DIODES

You can check diodes, transistors, and other semiconductors for opens, shorts, and normal operation with your multimeter. You can also determine the forward voltage for diodes, in-

cluding LEDs (light-emitting diodes) using this procedure.

Caution: Do not connect the test leads to a source of voltage when you set the function switch to •))/⊣. This could damage the meter or circuit.

1. Set the function switch to •))/⊣ then press the •))/⊣ button until ⊣ appears.
2. Remove power from the circuit you want to measure.
3. Connect the test leads across the circuit you want to measure, or remove one of the component's leads you want to measure from its circuit and connect the test leads across the component. Then note the first reading.
4. Reverse the test leads and note the second reading.

Note: The values that appear during the diode check show the actual forward voltage (max. 2.0V).

CHECKING CONTINUITY

You can use the meter to check for shorted or open electrical circuits.

1. Set the function switch to •))/⊣ then press the •))/⊣ button until •)) appears. **O.L** appears.

   Caution: Do not connect the test leads to a source of voltage when you set the function switch to •))/⊣. This could damage the meter.

2. Connect the test leads to the circuit to be checked. The display shows the actual resistance value. If the circuit resistance is less than 20 Ohm, the meter's buzzer sounds.

CHECKING 1.5V BUTTON-CELL BATTERIES

1. Set the function switch to 1.5V.
2. Connect the red test lead to the battery's positive (+) side, and black test lead to the negative (–) side.
3. The voltage value appears on the display.

USING THE DATA HOLD AND (POWER) RESET BUTTON

Using Data Hold

You can use the data hold feature to free your hands. Press **D.H./RESET**. **DH** appears and the measured data remains on the display.

Using Power Reset

If you do not operate the meter for about 10 minutes, the meter automatically turns off to save battery power.

To restore power quickly, press **D.H./RESET**. The display segments briefly light, and the previous data is lost.

Note: You can use the **D.H./RESET** button to restore power only when the meter has automatically turned off. You cannot use it to turn on the meter.

❒ Care

To enjoy your multimeter for a long time:

- Keep the multimeter dry. If it gets wet, wipe it dry immediately, and make sure that the meter is completely dry before using it.
- Use and store the multimeter only in normal temperature environments.
- Handle the multimeter gently and carefully. Do not drop it.
- Keep the multimeter away from dust and dirt.
- Use only a fresh battery of the required size and type.

Modifying or tampering with the multimeter's internal components can cause a malfunction and

might invalidate its warranty. If your multimeter is not performing as it should, take it to your local RadioShack store for assistance.

CLEANING THE MULTIMETER

To keep the meter looking new, occasionally wipe it with a cloth slightly dampened with water. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

Warning: Do not let any water drip inside the meter while cleaning it.

REPLACING THE BATTERIES

Your multimeter comes with two 357A alkaline batteries. When **BT** appears or the display dims or slows down, the battery power is low and the meter cannot measure accurately. Replace the batteries with fresh ones.

Warnings:

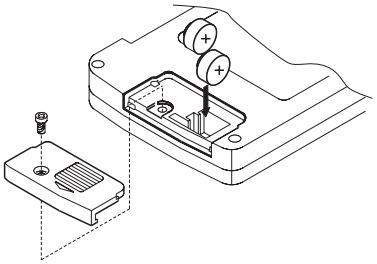
- To avoid electrical shock, disconnect both of the meter's test leads from any equipment before you install or remove the meter's battery.
- Keep button-cell batteries away from children. Swallowing a button-cell battery can be fatal.
- Do not operate your meter until the batteries are properly installed and the battery compartment cover is in place and secured.
- Dispose of old batteries promptly and properly. Do not burn or bury them.

Cautions:

- Use only fresh batteries of the required size and recommended type.

- Do not mix old and new batteries, different types of batteries (standard, alkaline, or rechargeable), or rechargeable batteries of different capacities.

Follow these steps to install batteries.



1. Set the function switch to **OFF** to turn off the multimeter.
2. Place the multimeter face down on a flat surface.

3. Using a Phillips screwdriver, remove the screw securing the battery compartment.
4. Slide the battery compartment cover in the direction of the arrow to remove it.
5. Remove the old batteries and replace them with new ones as indicated by the polarity symbol (+) marked inside the compartment.
6. Replace the cover and reinsert and tighten the screw.

Caution: If you do not plan to use the multimeter for a few weeks or longer, remove the batteries. Batteries can leak chemicals that can destroy electronic parts.

Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. EXCEPT AS PROVIDED HEREIN, RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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